REMARKS/ARGUMENTS

Claims 1-11 stand rejected in the outstanding Official Action. Claim 1 has been amended and therefore claims 1-11 remain in the application.

The Examiner's acknowledgment and review of the prior art submitted with Applicants' previously filed Information Disclosure Statement is very much appreciated. However, Applicants note that the present application is a national phase entry of an International PCT application. The U.S. national phase entry, therefore, has priority through the International application to the originally filed GB application. It is noted that the Examiner has not acknowledged Applicants' claim for priority under §119, nor has he certified constructive receipt in this national stage application. It is respectfully requested that the Examiner acknowledge not only the claim for priority, but the constructive receipt by marking boxes "12)," "a)" and "3." on the Office Action Summary Sheet conventionally attached Official Actions. The Examiner's correction of this oversight is respectfully requested.

Claims 1-9 stand rejected under 35 USC §112 (second paragraph) as being indefinite. The Examiner has correctly noted that "second sensor" at line 9 in original claim 1 should in fact refer to "said first sensor." Applicants have amended claim 1 to make this correction. Additionally, the phrase "containing" has been changed to read "contain" in claim 1, correcting the verb tense of the word. In view of the above amendments, there are believed to be no further bases of objection or rejection of claims 1-9 under 35 USC §112 (second paragraph) and any further objection or rejection thereunder is respectfully traversed.

Claims 1-3, 6, 7, 10 and 11 stand rejected under 35 USC §102 as anticipated by Pelc (U.S. Patent 4,663,591). The Court of Appeals for the Federal Circuit has noted in the case of

Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 USPQ 481, 485 (Fed. Cir. 1984) that "[a]nticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim."

Applicants' independent claim 1 describes a development of gating techniques, such techniques being discussed on page 1 of the present application. Magnetic resonance imaging requires a relatively long duration in order to develop the desirable tissue images. During this relatively long duration, the patient may make minor movements, such as breathing, etc. These movements interfere with the measurements, but where such movements are repetitive, there are various strategies developed to overcome the problems associated with patient movement during an MR imaging.

As discussed on page 1 of applicants specification, beginning at line 8, there are described various gating techniques which have been developed to improve image quality during patient movement. Generally, gating techniques seek to reduce motion artifacts (imaging artifacts created by patient motion) by collecting the k-space lines at times when the target has the same or highly similar phase in its motion. The major problem associated with such gating technique is that it undesirably lengthens the image acquisition time.

For example, the bottom of a signwave breathing cycle only exists for a short period of time and then the remainder of the cycle during which there is significant movement occurs. It may be necessary to collect data from a number of "bottoms" of cycles in order to acquire sufficient data for the desired image. Moreover, if a particular gate is chosen before image acquisition begins, that gate may not be effective due to changes in the periodic motion of the target during the image acquisition (in other words, if the patient moves slightly or changes their

breathing pattern). Conventional gating systems, however, have a gating window at some point during the periodic motion of the patient, and it is only during that window that image acquisition and data acquisition occurs.

The present invention addresses the shortcomings of conventional gating techniques by (1) acquiring all imaging data (regardless of the phase or portion of the patient movement cycle) and (2) classifying the acquired data into a group which is dependent upon the sensed position of the patient. As a result, during movement of the patient over a number of cycles or number of periods, a large amount of imaging data is collected and classified. Applicants then utilize their (3) "scan terminating logic" to detect that two or more groups of lines (in the data collected) corresponding to contiguous ranges of positions together contain a sufficient number of lines to derive an appropriate image. The particular group of lines which may be most appropriate is not normally known at the beginning of detection and data collection, it is determined by the scan terminating logic. After concluding that two or more groups of lines are sufficient for an image to be derived, (4) the data acquisition is terminated.

Since Applicants do not collect data based upon a gating window, the data collection needs some structure for keeping track of the data which occurs, especially over a range of patient positions Applicants' claimed "classifying logic" classifies the data which is detected by the first sensor in dependence upon patient position. Thus, Applicants' modified gating system requires the "classifying logic" and the "scan terminating logic" structures which are positively recited in Applicants' independent claim 1.

Where a conventional gating system acquires only lines in the predetermined gating window of positions (some small portion of all positions which the patient moves through during

a breathing or heart cycle), it requires sufficient data from a plurality of the gated period of time in order to generate the image. Applicants' claimed invention instead acquires all lines of data retrieved and then classifies those lines based upon their spatial position, and this is accomplished by the "classifying logic." Once the "scan terminating logic" determines that two or more groups of lines (which are sufficient to derive an image) have been acquired, then the scan is terminated.

Thus, what is important in the present invention is that there are sufficient data lines acquired, regardless of the specific spatial position and that once enough lines are available for the particular image, scanning can be terminated, whereas the prior art, by setting a particular gate or window portion of the patient's period of movement, it may require many data collections over a plurality of gated windows before sufficient data lines are accumulated to create an image.

As a result, Applicants' present invention, with its classifying logic and its scan terminating logic, permits classification and consideration of all lines, irrespective of the spatial position, and then determines when there are enough lines captured in order to generate an image. In its simplest form, the present invention is an improvement in the gating systems, in that all lines are collected and then, where there are sufficient lines to form an image, the scan is terminated and the image is formed.

The Pelc reference cited by the Examiner specifically discusses "gated scanning" (column 2, line 10) and then decides upon **a different method** to reduce image artifacts. Pelc is concerned with controlling the order in which lines of data are obtained in k-space in dependence upon a detected phase of motion (spatial position) of the target. Phases at which different lines

in k-space are captured vary in accordance with a predetermined pattern when the acquisition is eventually completed. In such situations, the phase of motion is monitored for a certain time and then an order of k-space line acquisition is determined, such that, when the k-space lines are acquired in that order, then, providing there has been no perturbation of the periodic motion of the target, the variation of periodic motion phase with acquired case base lines will follow the intended relationship. This is a way of reducing image artifacts, but is unrelated to the gated scanning techniques or Applicants' inventive method derived therefrom.

While conventional gated scanning systems know in advance which lines (i.e., the window or gate for scanning) may be useful, the present invention does not make any such decision in advance. All lines are acquired and only when two or more groups of lines are sufficient to enable an image to be generated, is the scanning terminated. In many instances, the acquisition of lines not specifically within the desired gate will be sufficient to create the desired image, thereby expediting the image formation and reducing the delay which is a problem in conventional gating techniques.

Accordingly, as noted above, since Pelc has nothing to do with gated scanning or improvements in gated scanning, it contains no disclosure of Applicants' classifying logic or Applicants' scan terminating logic. Pelc simply provides a different solution to the problem addressed by the Applicants' invention.

Inasmuch as the burden is on the Examiner to establish where or how Pelc teaches the structures recited in Applicants' independent claim 1, he has provided no indication of where there is disclosed Applicants' claimed "classifying logic" or the "scan terminating logic." Should the Examiner believe this structure to be disclosed in Applicants' independent claim, he

is respectfully requested to point out the column and line number of the Pelc reference in which it is disclosed. Absent such identification, the rejection of claims 1-3, 6, 7, 10 and 11 under 35 USC §102 as being anticipated by Pelc is respectfully traversed.

Claims 4 and 5 stand rejected under 35 USC §103 as unpatentable over Pelc in view of Zur (U.S. Patent 5,842,989), and claims 8 and 9 stand rejected under 35 USC §103 as unpatentable over Pelc in view of Vigen (U.S. Patent 6,044,290). Inasmuch as claims 4, 5, 8 and 9 ultimately depend from claim 1, the above comments distinguishing claim 1 from the Pelc reference are herein incorporated by reference.

The Examiner does not allege that the Zur or Vigen references contain any teaching of Applicants' claimed "classifying logic" or "scan terminating logic" (which are missing from Pelc) and therefore absent a disclosure of these features of claim 1, claims 4, 5, 8 and 9 cannot be obvious in view of any combination of Pelc and the other cited references. Again, should the Examiner be of the opinion that either Zur or Vigen contain any disclosure of the "classifying logic" or the "scan terminating logic," he is respectfully requested to point out the column and line number in these references which contain such disclosure. Absent any specific disclosure, it is submitted that claims 4, 5, 8 and 9 cannot possibly be considered obvious in view of the Pelc reference combined with the Zur or Vigen references.

Having responded to all objections and rejections set forth in the outstanding Official Action, it is submitted that claims 1-11 are in condition for allowance and notice to that effect is respectfully solicited. In the event the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or more of the above claims, he is respectfully requested to contact Applicants' undersigned representative.

Respectfully submitted,

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